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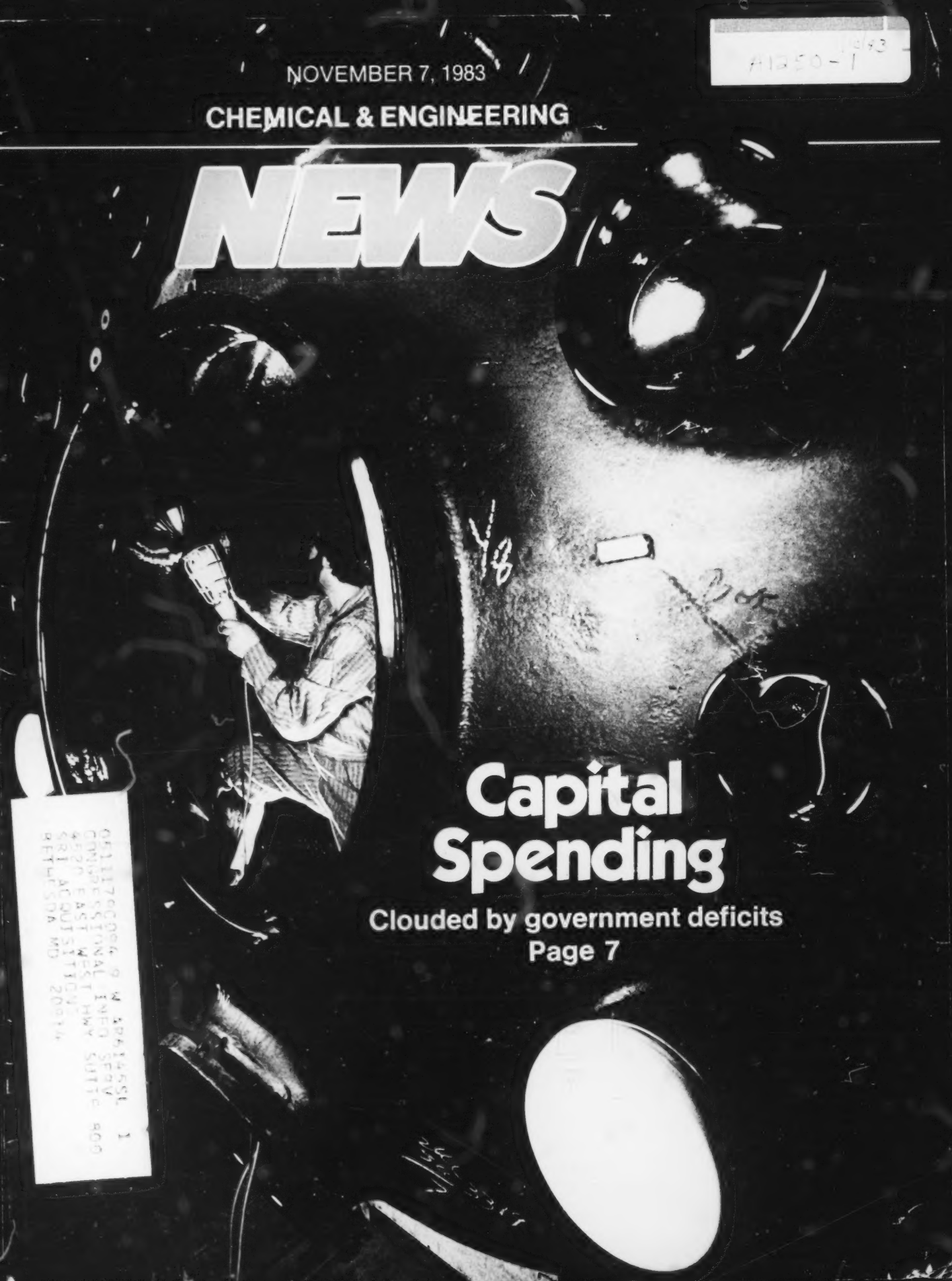
NOVEMBER 7, 1983

CHEMICAL & ENGINEERING

NEWS



Capital Spending

Clouded by government deficits

Page 7

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Cover: Pressure vessel—targeted for new plant—is inspected at Pfaudler unit of Standard Oil (Ohio) in Rochester, N.Y., by Charles Calaci. Photo by Steve Kahn

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CHEMICAL & ENGINEERING
NEWS
NOVEMBER 7, 1983

News of the Week

■ **AIChE celebrates diamond jubilee, joins ACS and University of Pennsylvania in sponsoring Center for History of Chemistry.** **Page 4**

■ **ACS balloting for 1984 president-elect fails to determine a winner; runoff election to be held.** **Page 5**

■ **Binary nerve gas weapons get setback with House defense appropriations bill containing no funds for their production.** **Page 5**

Business

Engineering thermoplastics undergo a welcome growth spurt after five years in the doldrums. **Page 10**

International

Specialty chemicals makers lured into fast-expanding electronics industry and carbon fibers despite fierce competition. **Page 12**

Radiation processing in polymers heads for wider success; use of gamma radiation slow to develop, shows promise. **Page16**

Government

Congress must act on appropriations bills for funding government agencies before its proposed Nov. 18 adjournment. **Page 24**

NIH receives a hefty 11.7% increase in its fiscal 1984 budget but DOE comes up short in some research funding areas. **Page 27**

Science

NSF report on trends in science and engineering lists scientific research areas that may affect national goals. **Page 36**

Technology

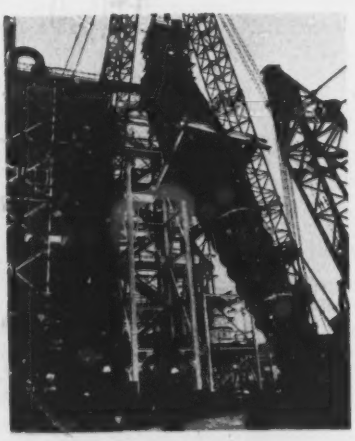
TVA research in phosphate fertilizer technology aims at processes using acid sludge, beneficiation of low-grade rock. **Page 37**

Portable field units communicate with process control systems to add versatility and convenience of operation, cut costs. **Page 43**

Letters 2

Concentrates
Business 6
Government 23
Science/Technology 30

The Departments
ACS Comment 44
Meetings 45
Newscripts 58



Cover Story

Chemical industry capital spending for plant and equipment may be hurt by the federal deficit, through high interest rates, tight credit. **Page 7**

Federal Deficit May Hurt Captial Spending

Massive government borrowing may lead to higher interest rates, slower growth, making capital formation hard for chemical industry

William J. Storck, C&EN New York

It may be sooner than most corporate planners think to start considering the next big wave of investment in plants and equipment in the U.S. chemical industry. The most important question may be whether, financially, any new wave can happen.

True, the recession left a gaping margin of unused plant capacity, and the universal assumption has been that a long break would follow in capital spending. But chemical economists are beginning to worry just the same. Although business conditions have improved dramatically and a good 1984 looks virtually assured, economists fret that just when new investment will be needed late in the year or in 1985, an ominous outside factor could shut it off—the capital-hungry U.S. federal budget, which promises a string of huge deficits sopping up much or most of the country's available credit. Such competition could be stifling for chemical and other manufacturing investment.

Currently, demand for chemicals is going so well that capacity utilization for chemicals and allied products, according to the government's survey, has moved up to 71% on a seasonally adjusted basis, compared with 65% at the beginning of the year and a 1982 low of about 64%.

C&EN's own survey of capacity utilization shows basic chemical plants operating at about 68% of nameplate capacity in the third quarter of this year and at about 76% of effective capacity (C&EN, Oct. 10, page 6). Production increased at the same time that some capacity was still being closed.

However, with capacity utilization moving up, it will not be long before chemical companies must begin to consider new capacity additions. And herein lies a problem,

NEWS ANALYSIS

according to many economists. They feel that just at the time that companies must begin a new round of capital spending, which has been declining in recent years, the federal budget deficit will make the cost of capital too expensive to justify new plants. This will be especially true in basic chemicals, based on the possible return on investment that the companies can get out of those plants.

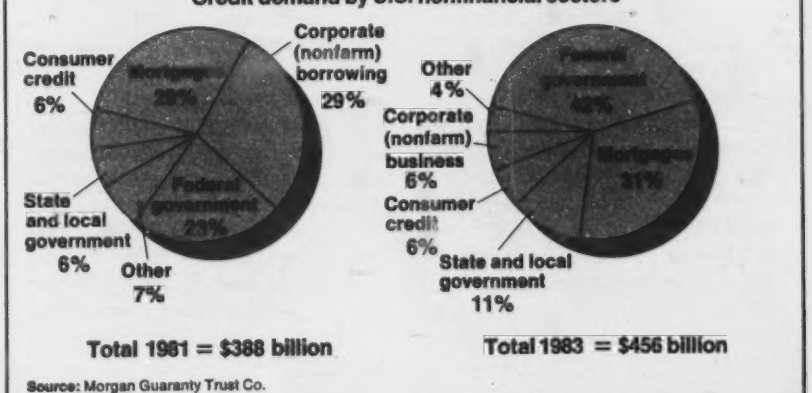
Since there is only so much credit available, the massive government deficits will take much of that credit. As one corporate economist says, "When you are competing against the government, there is no competition." The government, which can afford to pay any interest rate, will diminish the credit pool enough that interest rates will be bound to rise, making it much more expensive for corporations to borrow.

An example of just how much the government is taking was published recently by Morgan Guaranty Trust Co. The New York City-based bank says that in 1981, the federal government's share of credit demand was about 23%. This year, however, the federal government's share of domestic nonfinancial credit demand will rise to about 42%—almost a doubling in just two years.

Thus, the laws of supply and demand come into play, and as demand for the available credit increases, so will interest rates.

The problem is not immediate in that companies probably will not need to borrow much in 1984. James F. Smith, chief economist for Union

Federal share of credit demand almost double since 1981


Credit demand by U.S. nonfinancial sectors
Consumer credit 6%
Corporate (nonfarm) borrowing 29%
State and local government 6%
Other 7%
Total 1981 = $388 billion
Other 4%
Corporate (nonfarm) business 6%
Consumer credit 6%
State and local government 11%
Total 1983 = $456 billion

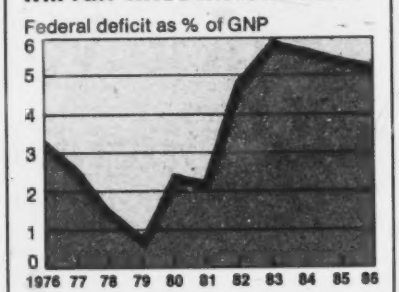
Source: Morgan Guaranty Trust Co.

Carbide, says that federal deficits will have little or no effect on capital formation until mid-1985 when the need for new plants becomes critical. Before that, he says, chemical companies will be able to finance capital improvements, which will be mainly in the form of new equipment or plant streamlining, out of internal cash flow. Smith says that the only time that companies will require larger financing in the next year and a half to two years is when they want to get into new lines of business or to adopt new technologies.

Nicholas Filippello, Monsanto's chief economist, says that "the microdecision to build a plant is affected only marginally by interest rates." Companies, he says, measure the investment against the cost of capital, which includes both debt and equity. They then aim for a return on investment that is higher than that cost of capital. However, since the interest rates are figured into this cost, the higher price that companies have to pay for debt does increase the cost somewhat. The problem, says Filippello, will be in the basic chemical area, where the returns are naturally lower.

Thus, some firms, for whatever reason, may have taken the right way when they decided to switch their emphasis to the higher-value-added specialty chemical products since these will be more likely to give returns higher than the cost of capital to build new plants.

Deficits as per cent of GNP will run twice historic rates



Sources: Bureau of Economic Analysis, Conference Board, C&EN estimates

In fiscal 1982, the federal deficit was about $147 billion. In fiscal 1983 it was $195 billion, according to the latest government figures, and there it will stay for some time. Defense spending plus entitlements plus interest payments of the federal debt adds up to about 80% of the federal budget. The government's own estimates are that these will rise to 88% in just a few years. Thus, the government is projecting deficits in the $190 billion range for the next three years.

This means that the federal deficit will amount to about 6% of the U.S. gross national product in 1983. In other words, the deficit robs about 6% of GNP. Although this percentage will trend downward for the next few years, if the deficit remains at about its current level and GNP rises, it still will be above 5% of GNP in 1986, according to the Conference Board, a New York City-based business group. This is more than twice what the percentage was just three years ago in 1980 when it was 2.3% and about three times the historic level.

Monsanto's Filippello, who is also president of the National Association of Business Economists, says that the ratio of deficit to GNP is not the whole story. He points out that in many other countries this percentage is high, but that these other countries have a high rate of savings that will finance the deficit. This, he says, is not true in the U.S., where the federal deficit takes up to 75 to 80% of savings. Some economists say that when off-budget items are added, the deficit exceeds the available savings.

This means that the deficit must be financed by capital inflows—monies coming into the U.S. from other parts of the world—which keeps interest rates high, makes the dollar stronger than it should be against foreign currencies, and draws capital away from other parts of the world.

Carbide's Smith feels that as the recovery progresses, government revenues increase, thus cutting the projected future deficits somewhat. In fact, he is worried that if the deficit goes down, Congress will not focus on the problem and the actions that need to be taken. "Before you know it we could have a $300 billion deficit," Smith says.

In a talk to the Conference Board's Business Outlook Conference in New York City earlier this fall, Du Pont's vice president of finance, William E. Buxbaum, said that there are three reasons for the higher cost of money compared to historical norms. These are the deregulation

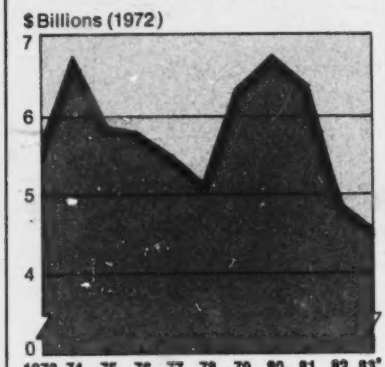
A dissenter downplays deficits' damage

Not everyone agrees that deficits are, in themselves, bad for the economy and for investment. One of the dissenters is Albert M. Wojnilower, managing director and chief economist for First Boston Corp., headquartered in New York City. At a meeting of economists discussing the "Economics of Large Government Deficits" held at Melvin Village, N.H., last month, Wojnilower said that placing the blame on the budget deficit "is a cop-out."

Wojnilower told the meeting, which was arranged by the Boston Federal Reserve Bank, "Government deficits may well promote rather than deter investment." According to the economist, the government is likely to borrow to finance its own investment outlays and to finance grants-in-aid earmarked for state and local investment outlays. It borrows to finance investment tax credits, accelerated depreciation allowances, and other subsidies that support private investment. Wojnilower then asks the question, "Would narrowing the budget deficit by the abolition of these tax incentives promote private capital spending?"

Wojnilower says that in most cases more borrowing and more spending raise the level of nominal income, investment, and saving. If the extra debt, he says, is private debt, private saving will tend to expand because someone has to hold the extra securities. If the extra securities are government debt, private saving again will be higher. However, then national saving as it is measured cannot be higher because the larger government deficit is defined as dissaving. He allows that the result will be inflation, but, Wojnilower says, as long as prices inflate faster than costs, profits and investment will thrive.

Capital appropriations for chemicals continue to fall



a C&EN estimate. Source: Conference Board

of financial institutions, a higher risk factor, and concern about huge projected structural budget deficits. He says that the risk factor and concern about budget deficits are manifestations of the same problem—inflation and interest rate expectations over the medium and longer term.

In fact, economists are worried about more than rising interest rates. They fear that the large federal deficit could cause a number of other problems including inflation and a slowing in the economy, or a combination of the three. And, they say, if the deficits slow the economy in 1985, largely because of the inability to create capital, the situation would feed on itself. As the economy would slow down, the government's revenues would decline, creating even larger deficits.

Filippello says that four things could be done to cut the deficit. The government could cut growth in outlays with a net shift back toward the private sector. However, this is unlikely in an election year. Another move that would be unpopular, hence unlikely, in an election year would be an increase in taxes. However, this would not balance the budget because an increase in taxes means less money in the economy. The government could borrow money from the private sector, an action that would put a limit on spending for housing and capital goods and could renew the recession. Or the Federal Reserve could expand the money supply. In this regard, most economists agree that it is possible for the U.S. to inflate itself out of deficit problems as it did in the late 1970s.

Filippello adds that taxes may be raised and outlays may be cut, but not until after the election. The key question then is whether this is soon enough. Most projections see the crunch hitting in 1985. If this is true, just at the time that the chemical industry will need to begin to build new plants, the scramble for credit will take place. Or in the worst case, if the deficit causes another recession, the question becomes: Will cutting the budget in late 1984 or early 1985 stop a slowdown that already may be built in for that year? □

Engineering plastics head for new growth

After a frustrating half-decade, one of the high-premium parts of the U.S. plastics industry may be about to break loose for vigorous new growth. Engineering thermoplastics—high-property materials used in diverse structural applications from business machine housings to auto exteriors—could jump about half in U.S. use from 1982 through 1987, concludes consultants Business Communications Co. of Stamford, Conn., in a new report. That would produce a 1 billion lb annual market.

This is a welcome spurt for engineering thermoplastics, which have been in the 650 million to 850 million lb range since 1977. Producers of these materials were not accustomed to standing still, having more than doubled their business in the previous five years.

Strong new growth will bring some changes. First, it will not be uniform and will cause some lineup changes among major materials, with some growing considerably faster than others. Second, it will not be a waltz for all aspiring companies wanting to join in.

Among materials, polycarbonate finally will become the leader after 8.5% compound annual growth carrying it past 300 million lb per year, the report predicts. Falling to second slot will be nylon, whose 5.4% clip still will take it past 300 million lb. Unchanged in third place will be polyphenylene oxide-based resins, although this group will have the highest percentage growth at 9.6% per year. Polyacetal will have a more stately pace at 5.5% per year, and disappointing thermoplastic polyester a 7.7% pace to less than 100 million lb unless major new applications come through.

Engineering thermoplastics use will rise 8% per year in mid-80s

Millions of lb	1982	1987	Annual change, %
Nylon	243	315	5.4%
Polycarbonate	211	318	8.5
Polyphenylene oxide-based resin	112	177	9.6
Polyacetal	83	108	5.5
Thermoplastic polyester	53	77	7.7
High-heat resins	20	61	25.5
TOTAL	722	1056	7.9%

Source: Business Communications Co.

Outside these standard resins, another group of high-heat resins will be growing much faster—25.5% per year compounded—but from a very small base, BCC estimates. Rising to 61 million lb per year in 1987, this group includes polysulfone growing at 10.8% per year, polyphenylene sulfide at 10.2%, and polyarylates at 22%. One other material, polyphenylene ether, will climb from next to nothing to 20 million lb in 1987.

Although resin growth will be across the board, managing it will not necessarily be easy, especially for newcomers in a proliferating product scene. The report forecasts that technical and market competition will become very keen, although the basic industry structure will not change very much. One reason is that industry leadership might just get stronger in this concentrated business. According to the report, "There is an ever-widening gap in total pounds of engineering resins sold by the number one supplier. Number two supplier sells less than half of what number one sells, and number three sells about 70% of what number two sells. And company sales rapidly diminish after that. We do not see this situation changing to any great degree." □

Electronics, Carbon Fiber Markets Lure Specialty Chemical Makers

Competition in both these fast-growing areas, however, is intense, plus development costs can be high and prices of many items are declining

Specialties have become the catchword of the chemical industry. As commodity producers continue to experience narrow profit margins, there is a growing tendency for them to switch their efforts to development of specialty chemicals lured by the prospect of heftier profits.

Two areas that have attracted increasing interests are the chemicals needed for the fast-expanding electronics industry, and carbon fibers. But a note of caution was sounded at the joint meeting of the European Chemical Market Research Association and the U.S. Chemical Market Research Association in Venice, Italy. Competition in both areas is intense, development costs can be very high, and prices of many items are coming down.

In the field of electronics chemicals, "continuing competitive pressures dictate that management must be willing to constantly change and improve manufacturing technology," observes David S. Cox, director of the specialty chemicals department within SRI International's chemical industries division in Menlo Park, Calif. "The successful specialty chemicals supplier must work with its customers to coordinate its product development with manufacturing changes." Nevertheless, he adds, "the longer-range forecasts are still excellent, despite the current recession."

As for carbon fibers, Richard M. Kossoff, head of the New York City-based company that bears his name, makes a point that "many firms have made substantial investments in high-technology markets on the assumption that they ultimately would generate significant return on investment. Some are beginning to realize, however, that the label 'high tech' does not automatically mean high profit, especially where accessibility of technology has led to excess penetration [of the marketplace]. The result is overcapacity, price discounting, poor returns, and management disallusionment.

C&EN staff photo

Cox: forecasts are still excellent

"The lesson to be learned," he says, "is that before entering they must carefully pinpoint which segments are truly high tech and high profit. The carbon fiber composites industry probably will undergo a shakeout in the near future as some managements in the lower technology end lose patience with poor returns. Long range, companies with patient money, dedicated to developing the most advanced technology, from precursor to final product, will exhibit outstanding profit."

The electronics chemicals market has become one of the most popular areas for business diversification in the chemical industry, Cox notes. "High prices, the profit margins they often represent, and market growth rates that are well above the average for the chemical industry, have attracted numerous companies to the field."

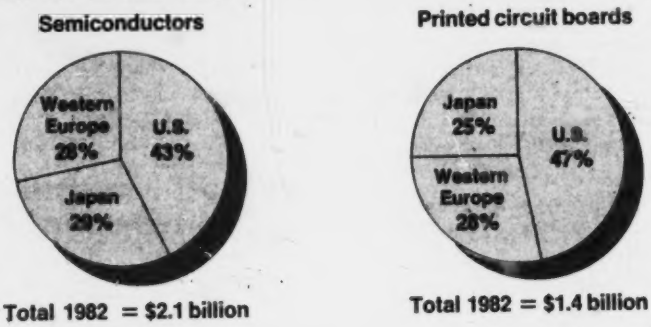
High prices also allow development work to be performed rapidly during the early stages of product use. Some developmental electron beam photoresists, for example, have sold for as much as $800 a liter. But because quantities of most specialty chemicals used in an electronic device are minuscule, their cost represents only a small fraction of the final cost of the product.

Confining his remarks to chemicals used in semiconductors and printed circuit boards, Cox believes that global sales could move up from last year's $3.5 billion to $6.8 billion in 1987 (based on a constant 1983 dollar value). During this five-year period, the geographical demand pattern will shift somewhat, he and his associate Alan R. Mills maintain. By 1987, they see U.S. sales accounting for 40% ($2.72 billion) of the total, followed by Western Europe with 31% ($2.11 billion), and Japan with 29% ($1.97 billion).

In contrast, the U.S. represented 45% ($1.58 billion) of the 1983 total, with sales in Western Europe amounting to 28% ($980 million), and in Japan, 27% ($950 million). Put another way, the annual rate of demand growth in Western Europe between 1982 and 1987 is foreseen at almost 17%, and in Japan nearly 16%, whereas that for the U.S. is put at 11.5%.

In dollar terms, semiconductors

Specialty chemicals sales in electronics industry by region breaks down this way



Source: SRI International

provide the largest outlet for specialty chemicals. Of last year's $3.5 billion in sales, 60% went toward semiconductors, 40% to printed circuit boards. This lead likely will be maintained through 1987, when semiconductors likely will account for 62% of the $6.8 billion total.

A wide variety of chemicals goes into making semiconductors. Substrate materials make up the largest functional class, 44% ($924 million) of last year's $2.1 billion. Here, silicon plays the dominate role, although some germanium, and compound semiconductors like gallium arsenide and indium phosphide—preferred in solid-state lasers and light-emitting diodes—are used.

Running a close second at 41% ($561 million) of sales are packaging materials needed to protect semiconductor devices and to support input and output leads. Foremost among these are ceramics, accounting for 41% of packaging chemicals' dollar value last year, pastes (about 22%), and encapsulating resins (10%). Also included are the more specialized die-attach adhesives (10%) used to bond the integrated circuit chip to its support prior to encapsulation. Miscellaneous items make up the balance, the most significant being conductive and rare-earth compounds, and soft ferrites.

Rounding out the classes of chemicals used in semiconductor manufacture are process chemicals and etchants (9%) and photoresists (6%). Processing chemicals embrace an exceedingly complex variety of products, Cox notes. At least 65 specific organic chemicals and upward to 20 inorganic chemicals are on the market. Mixtures of organic and inorganic formulations run into the hundreds, many of them specified by the users. Specifications governing impurity levels and the like can run as high as 40 per chemical. As a result, manufacturing and quality control are costly.

Printed circuit boards perform the very important function of interconnecting the many input and output leads of the semiconductor and other components in an electronic product. The U.S. holds the largest market share of the chemicals used in making them because of the high-performance products needed in aerospace, computer, and military applications.

Of the $1.4 billion in global sales of chemicals that last year went into printed circuit boards, substrate materials accounted for 61%. The most widely used items are glass- and paper-reinforced epoxy resin composites. The higher market share for glass-reinforced boards in Europe and the U.S. reflects the larger amounts of nonconsumer electronic equipment made there. Other components of the market are photoresists and process chemicals (16%), and plating and etching chemicals (13%). Adhesion promoters, cleaners, degreasers, inks, and the like make up the 10% balance.

In the field of carbon fibers, growth and profit opportunities a decade or so ago seemed virtually unlimited as early success in sporting goods spread to higher performance markets such as the aircraft and aerospace industries, Kossoff recalls. Projected demand for weight reductions, with associated savings in energy, appeared to justify high prices.

Some firms were predicting that U.S. carbon fiber sales would reach 5 million lb or more by 1983. As a result, capacity surged, now exceeding demand. However, sales this year will fall short of 2 million lb. Prices meanwhile have drifted down to the $15 to $35 per-lb range.

"When the high estimates were made," Kossoff remarks, "forecasters could not foresee that the world recession would severely weaken the auto and aircraft industries. Car producers simply could not pay a premium for weight reduction, and fewer [airplanes] were being built."

The economics of the business for individual producers is made worse by the larger number of suppliers. Today, there are seven U.S. makers of carbon fibers compared to three in 1975. Worldwide, there are about 16 polyacrylonitrile-based carbon fiber companies, about four that make fibers from pitch.

One tack that managements are taking is to integrate forward into production of carbon fiber prepregs, mainly by acquiring existing companies, and a final composite structural part. Kossoff notes that although fiber sells at an average of $27 a lb, the average selling price of prepregs stands at $55 a lb, and that of structural composites is $175 a lb. He estimates that fibers themselves account for 20% of sales, prepregs 55%, and structural composites 25%.

Despite the problems that have been encountered, Kossoff is optimistic that growth of carbon fibers and composites made from them will be good. "U.S. carbon fiber sales could grow from about 1.7 million lb this year to between 3.6 million and 4 million lb by 1987, and between 5.5 million and 6.6 million lb by 1992.

"This growth will reflect penetration of new markets made possible by higher propertied fibers that will allow specification in primary aircraft structures, selected auto parts, and defense products," he reasons. "In addition, lower-propertied pitch- and polyacrylonitrile-derived carbon fibers are growing in new areas, including asbestos replacement, furnace insulation, and protective clothing." □

NIH funding is up all-around, DOE gains a little

Congress continues to slog through its task of setting the final fiscal 1984 funding levels for the federal research agencies, having just completed work on the Department of Energy and National Institutes of Health budgets. Still to go are the budgets for the departments of Agriculture, Commerce, and Defense. And it's getting a bit late—the new fiscal year began Oct. 1.

Following the usual pattern, Congress was much more generous than the Administration in funding NIH, handing it an almost 12% increase instead of the requested 1%. But Congress appears to be tiring of the annual game in which the Administration requests less than it wants for NIH, knowing that Congress will take up the slack.

What most raised the ire of both the House and the Senate this year was the Administration's decision in January to fund only 3676 new and competing grants rather than the normal 5000. In April the Administration came back with a new budget proposal for NIH that did include 5000 grants, but it didn't ask for any more money to finance the additional 1324 grants. Instead it decided not to provide full-cost new and continuation research project grants, but to trim those awards by about 11% and 6%, respec-

Congress sets nothing but increases for NIH . . . .

$ Millions	1984 Appropriation	1984 Request	1983	% change 1983–84
National Institutes	$3954.0	$3609.9	$3539.9	11.7%
Cancer	1053.4	963.9	962.6	9.4
Heart, Lung & Blood	674.7	509.2	595.7	13.3
Arthritis, Diabetes & Digestive & Kidney Diseases	442.5	406.5	393.4	12.5
General Medical Sciences	366.8	338.2	321.0	14.3
Neurological & Communications Disorders & Stroke	325.5	292.3	287.4	13.2
Allergy & Infectious Diseases	305.7	280.8	270.3	13.1
Child Health & Human Development	265.0	247.3	244.9	8.2
Environmental Health Sciences	173.0	160.6	158.1	9.4
Eye	150.8	138.7	138.0	9.3
Aging	112.3	97.2	91.6	22.6
Dental Research	84.3	75.2	76.9	9.6
Research resources	241.9	201.1	213.2	13.5
National Library of Medicine	42.1	42.0	44.8	0.2
Office of the Director	26.7	26.7	25.7	3.9
Research facilities	25.0	19.9	17.5	42.8
John E. Fogarty Center	11.3	9.2	10.1	11.9
TOTAL	**$4301.0**	**$3908.8**	**$3851.2**	**11.7%**

. . . . but cuts some DOE energy research programs

$ Millions	1984 Appropriation	1984 Request	1983	% change 1983–84
Energy supply R&D	$1933.8	$2066.4	$2136.5	−9.5%
Nuclear	636.6	853.2	815.4	−22.0
Magnetic fusion	470.8	467.0	466.1	1.0
Supporting research and technical analysis	395.1	408.5	328.3	20.3
Environmental research	222.6	210.6	224.3	−0.7
All other	208.7	127.1	302.4	−31.0
Weapons R&D	829.6	819.0	742.2	11.8
General science and research	638.2	645.2	546.7	16.7
Fossil R&D	259.2	94.0	197.4	31.3
Conservation	150.9	71.1	133.6	12.9
TOTAL	**$3811.7**	**$3695.7**	**$3756.4**	**1.5%**

Announcing DuPont's four newest "Idea Intermediates."

The newest additions to the family of DuPont "Idea Intermediates," shown on the opposite page, are:

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$B(C_6H_5)_3$

Triisopropylborate
$B[OCH(CH_3)_2]_3$

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tively. Reimbursements for indirect research costs also would have been cut, by about 10%.

Congress would have none of it. It restored all of the money that would have been cut from other programs to support the grants, including $53 million for the support of research centers, $25 million for biomedical research supporting grants to educational institutions, and $17 million for noncompeting research projects. And it added enough money to support the expanded grants program. Congress also rejected any arbitrary, across-the-board cuts in indirect cost reimbursements. Rather, the Senate Appropriations Committee suggested that as a way of checking indirect costs, those associated with each grant be shown on each individual award. The committee directed NIH to do so by July 1, 1984.

The Department of Energy's research programs did not fare quite so well. Funding for some programs is set well below fiscal 1983 levels, whereas others get major increases. Still, with three exceptions, Congress provided more money than had been requested by the Administration for the various energy research programs.

One of the exceptions is nuclear fission R&D, the budget request for which was cut 25% to about $637 million. Congress cut all of the $270 million requested for the Clinch River breeder reactor demonstration project. But then it turned around and added $53.4 million to the budget request for DOE's other nuclear programs. The second exception is found in the supporting research and technical analysis program, specifically in basic energy sciences. Congress cut the $25.9 million requested for a new National Center for Advanced Materials at Lawrence Berkeley Laboratory down to $3 million. Discounting that, funding for materials science is up 20% to $144 million, and funding for chemical sciences is up 9% to $82.5 million.

The third exception is general science and research where Congress cut $10 million from the budget request for high-energy physics—primarily from the construction budget—and added $3 million to the request for nuclear physics. □

Can we help y

–CH$_2$OH→CH$_2$

>C=CH$_2$→–C–

Cl